

# The Importance of Preventing Bovine Respiratory Disease: A Beef Industry Review

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## Abstract

Segmentation within the beef industry creates differing perspectives of the true worth of cattle. This is especially apparent for cattle that have been managed through some type of value-added health program. Understanding each segment's role in value integration becomes increasingly important as vertical cooperation increases within the industry. Sickness, usually manifested as Bovine Respiratory Disease (BRD), in newly received calves illustrates the importance of preweaning health management to cattle buyers because it is directly related to economic risk. Morbidity rates can have a dramatic economic impact because of losses associated with mortality, realizers, reduced performance and carcass value reduction. Health programs are designed to minimize morbidity risk of feeder cattle, and to provide some method of documenting the preventive management program conducted prior to sale. A variety of programs exist to compliment varying cow/calf management schemes. Preconditioning programs represent the most comprehensive tool to prevent morbidity upon arrival. Preconditioning programs address both sides of the morbidity equation: they are designed to reduce the incidence of BRD by increasing resistance, while simultaneously reducing stress prior to and after shipment. However, the cattle industry has been slow to adopt preconditioning programs. This has occurred primarily as a result of ranchers' efforts to reduce input costs, along with increasing consolidation within the feeding industry. Nonetheless, source-verified, preconditioned calves generally are at reduced risk of morbidity, thereby potentially reducing feedyard operating costs. The cost of disease prevention programs and their effect on morbidity must be appropriately evaluated, however, within the given economic environment. Calf producers and practitioners are encouraged to under-

stand the various factors that cause variability in feeder cattle prices in order to reduce exposure to excessive market risk, and maximize net return of the cattle that they produce.

## Résumé

La segmentation au niveau de l'industrie du bœuf engendre des points de vue différents sur la vraie valeur du bétail. Ceci est particulièrement évident pour le bétail issue d'un programme de conditionnement. Une meilleure compréhension du rôle de chaque segment dans l'intégration de la valeur devient de plus en plus importante compte tenu de la plus grande intégration verticale dans l'industrie. La maladie, souvent sous la forme du complexe respiratoire bovin (CRB), chez les jeunes veaux nouvellement acquis montre bien l'importance d'un programme de santé pré-sevrage auprès des acheteurs de bétail en raison des risques économiques occasionnés. Le taux de morbidité peut avoir un impact économique dramatique à cause des pertes associées à la mortalité, aux atouts et à l'amoinissement des performances et de la valeur des carcasses. Les programmes de santé visent normalement à décroître le risque de morbidité pour le bétail et à permettre la documentation du programme préventif de gestion qui a été suivi avant la vente. Une gamme de programmes peuvent compléter les programmes de gestion des élevages vaches-veaux (vaches allaitantes). Les programmes de pré-conditionnement représentent l'outil le plus versatile pour prévenir la morbidité lors de l'arrivée. Ces programmes mettent l'accent sur deux facettes de la morbidité; ils permettent de réduire l'incidence du CRB par l'augmentation de la résistance et par la réduction du stress avant et après le transport. Toutefois, l'industrie du bétail ne s'éveille que lentement aux

programmes de pré-conditionnement. Ce lent éveil reflète l'effort des producteurs de bétail pour réduire les coûts d'achat de même que la consolidation croissante de l'industrie de l'alimentation. Néanmoins, les veaux pré-conditionnés ont un moindre risque de morbidité ce qui permettrait de réduire les coûts d'opération des parcs d'engraissement. Le coût des programmes de prévention des maladies et leur effet sur la morbidité doivent être évalués adéquatement dans le cadre approprié des conditions économiques. Les producteurs de veaux et les praticiens devraient être encouragés à comprendre les nombreux facteurs qui engendrent des fluctuations dans le prix du bétail pour permettre de réduire l'exposition au risque excessif du marché et maximiser les profits provenant du bétail produit.

## Introduction

Inherently, segmentation within the beef industry creates differing perspectives of the true value of cattle; respective segments are essentially antagonistic sub-industries. This is especially apparent for cattle that have been managed through some type of value-added program. Stockers, backgrounders and cattle feeders typically maintain a "discount" market perspective, reflecting their priorities as margin operators. The mean economic return on fed cattle was 45 cents per head between 1980 and 1999;<sup>5</sup> those operators who failed to manage costs have suffered tremendous economic losses. Conversely, cow/calf producers commonly view the market from a "premium" perspective—they desire to be paid more for additional inputs. This perspective is largely a result of economic pressure on cow/calf operations during the past 25 years. During that time, cow/calf operations have experienced an average annual loss of \$8.41 per cow.<sup>25</sup>

All segments of beef production must understand potential value losses associated with each segment of production. Understanding each segment's role in value integration becomes increasingly important as vertical cooperation increases within the industry.<sup>53</sup> Awareness of factors that influence profitability within each respective production segment allows both buyers and sellers to make more informed, intelligent and fair decisions in each transaction. The objective of this review is to outline economic shortfalls associated with disease, market principles and industry application of disease prevention.

## Review and Discussion

### *Economic costs associated with disease*

Sickness in newly received calves demonstrates the importance of preweaning health management because

it is directly related to economic risk. Concern about morbidity and its relationship to profitability is justifiable, as disease costs have the greatest impact on profitability in feedlot cattle independent of market transaction prices.<sup>13</sup>

Bovine Respiratory Disease (BRD) is the most common disease of feedlot cattle, accounting for approximately 75% of total morbidity cases.<sup>11,17</sup> It is considered to be the primary disease of newly weaned and/or received calves.<sup>55</sup> The highest incidence of BRD generally occurs within the first 45 days of arrival.<sup>11</sup> BRD morbidity rates typically range from 0-70%, with most loads of cattle falling within the 15- 45% range.<sup>18</sup> Additionally, BRD is responsible for approximately 45-55% of all deaths in the feedyard.<sup>11,48,60</sup> BRD morbidity rates are highly correlated with mortality rates and treatment costs,<sup>28</sup> accounting for approximately 8% of total production costs, not counting losses related to reduced performance.<sup>15</sup>

In a six-year summary of the Texas A&M Ranch to Rail program (Table 1), there were marked differences in economic return between cattle which remained healthy throughout the feeding period compared to those which had been sick.<sup>29-36</sup> Cattle treated at least once had higher production costs and poorer feedlot performance. Furthermore, cattle treated for disease produced carcasses with lower marbling scores and lower USDA quality grades. Calves remaining "healthy" throughout the feeding period returned over \$95 per head more than those that were in the "sick" category.<sup>29-36</sup>

Clinical illness is clearly associated with increased production costs and has been estimated to cost the beef industry \$500 million annually.<sup>42</sup> However, sub-clinical illness also leads to increased costs of production while simultaneously causing reduced performance and decreased carcass value.<sup>48,57,62</sup> With current technology, it is not possible to identify all sick calves. The Strategic Alliance Field Study estimated that for every calf pulled from its pen for treatment there are likely two calves that experience sub-clinical illness.<sup>43</sup> Wittum *et al* found that although 35% of steers involved in a feeding trial were treated for BRD, 72% of the steers had lung lesions at slaughter, suggesting that a significant proportion of the population had a subclinical respiratory tract infection.<sup>62</sup> The authors concluded that treatment of clinical cases of BRD may be inadequate to prevent economic losses from BRD.<sup>62</sup> Similarly, Gardner *et al*<sup>14</sup> reported that 33% of steers had lung lesions at slaughter; the proportions were equally distributed among cattle that were treated for BRD and those that were not. Steers without lung lesions returned an average of \$20.03/head more than those with lung lesions and non-active lymph nodes. The economic return for steers with no lung lesions was \$73.78 more than steers that had both lung lesions and active lymph nodes.

### Disease prevention

The primary objective of health programs is to minimize morbidity risk of feeder cattle, and to provide some method of documenting the preventive management program conducted prior to sale. A variety of programs exist to compliment varying cow/calf management schemes. These programs contain combinations of vaccination regimes and/or weaning management.

Unfortunately, it is impossible to accurately predict the health performance of feeder steers and heifers. However, in an effort to better manage risk, cattle buyers often seek information regarding management prior to shipment. Several years ago, a survey conducted by Cattle-Fax® revealed five items of information most often requested by calf buyers.<sup>3</sup> They are ranked in order of importance:

1. vaccination program
2. date weaned
3. breed of sire and/or breed composition of cow herd
4. have calves been weaned?
5. weaning ration/nutrition program.

Four of the top five items are directly related to the health of the calves. Nearly 100% of the respondents recommended some type of written form for transferring calf information, such as letters, checklists, certificates and notarized forms. Over 70% wanted this information prior to negotiating a price, or even viewing the calves.<sup>3</sup> Health status is extremely important to calf buyers, and improved communication in most cases equates to increased value.

**Table 1.** Relationship of sickness to performance and value differences in the Texas A&M Ranch to Rail Program – 1992 through 2000<sup>a</sup>.

Year	No. head	ADG (lb/d)	Total cost of gain (\$/cwt)	Medicine cost (\$/head)	% Choice	% Select	% Stand.	Profit / loss (\$/head)
Morbidity Status "Sick" <sup>b</sup>								
92-93	347	2.68	59.67	27.36	28	70	2	85.15
93-94	1113	2.69	67.33	37.90	19	73	8	(86.38)
94-95	667	2.99	54.46	20.76	33	63	4	26.14
95-96	857	2.91	72.89	34.05	32	56	12	(63.02)
96-97	298	2.40	76.95	23.36	26	60	14	(5.23)
97-98	507	2.54	71.15	22.73	23	60	17	(101.57)
98-99	159	2.64	62.07	21.39	24	65	11	0.70
99-00	218	2.65	62.32	26.78	37	53	10	23.31
Total	4166							
Mean <sup>c</sup>		2.74	66.22	29.39	27	64	9	(36.25)
Morbidity Status "Healthy" <sup>b</sup>								
92-93	1235	2.88	50.36	0.00	40	55	4	176.38
93-94	2155	2.92	56.16	0.00	26	67	7	2.17
94-95	2206	3.02	50.67	0.00	39	59	2	75.69
95-96	2017	3.01	65.34	0.00	38	54	8	(3.40)
96-97	1774	2.96	59.52	0.00	40	55	5	112.19
97-98	1394	2.84	59.53	0.00	42	51	7	(36.18)
98-99	978	3.07	51.53	0.00	41	54	5	80.82
99-00	1080	3.08	49.03	0.00	54	43	3	146.17
Total	12839							
Mean <sup>c</sup>		2.97	55.98	0.00	39	56	5	59.83

<sup>a</sup>Adapted from McNeill (1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000).<sup>29-36</sup>

<sup>b</sup>"Sick" equivalent to at least one treatment required during the feeding period.

"Healthy" equivalent to no treatments required during the feeding period.

<sup>c</sup>Figures reported are weighted means.

Due to the interactive nature of various stressors and risk factors, quantification of individual risk relative to BRD is very difficult. Stressors, either individually or in combination, cause several important responses in newly arrived feedlot calves, including transient endocrine responses, altered products of energy and protein metabolism, changes in appetite and growth rate, and possible limited compromise of digestive and rumen function.<sup>26</sup> All of these physiological responses result in some degree of immunosuppression. As such, any effort to reduce stress and/or improve immunocompetency should improve health and subsequently decrease BRD risk upon arrival.

#### *Disease and cow/calf management factors*

Management practices at the farm or ranch of origin are correlated with the health of the calf later in life. For example, passive transfer of colostral antibodies affects the health status of a calf throughout its life. The amount of colostral antibodies absorbed is related to colostrum quality, quantity of colostrum ingested and absorption of the antibodies. Failure of passive transfer (FPT) can result from a variety of risk factors including lack of effective vaccination, cow prepartum nutrition, body condition score, udder structure, mastitis and dystocia.<sup>45,49,50</sup> Calves that experience FPT are three times more likely to develop BRD in the feedyard.<sup>61</sup>

Several other important factors are related to the health performance of calves. These factors may not be directly associated with morbidity, but instead are often associated with cattle that do not look “healthy” or “fresh”, and producers may be paid accordingly. This is especially true of cattle produced in the southeastern United States which present some unique challenges that result from a marketing system that involves commingling, sorting and transportation of cattle. Additionally, southeastern cattle are often heavily parasitized and fescue toxicosis is common. Calves with fescue toxicosis often have long, rough hair coat, and commonly have an elevated body temperature, which can lead to excessive morbidity and mortality rates.<sup>47</sup>

Mineral deficiencies can also lead to immune suppression and limit a calf's response to vaccination. Recent research on the relationships between minerals and the immune system has focused primarily on zinc, copper and chromium.<sup>12</sup> Many forages may be deficient in these particular micronutrients,<sup>9</sup> thereby increasing the potential for disease. Furthermore, decreased feed intake in newly received calves makes correction of these nutritional deficiencies difficult. The nutritional history may become an important factor in marketing calves in the future.

#### *Vaccination*

Preweaning vaccinations are important for timely immunity and to reduce postweaning economic

losses due to disease. National Animal Health Monitoring System (NAHMS) survey results indicate that most feedyard respondents (65.8%) felt that vaccinating calves at least two weeks prior to weaning is “extremely” or “very” effective in reducing sickness and death loss; 67.2% believed weaning to be an “extremely” or “very” effective tool in reducing morbidity rates.<sup>40</sup> Additionally, buyers are often interested in the type of vaccine used (killed or modified live) and the timing of vaccine administration. If the vaccine is administered at weaning, fewer buyers (51.2%) perceive similar levels of effectiveness as compared to pre-weaning vaccinations.<sup>40</sup>

Cattle which have been vaccinated prior to weaning not only experience lower morbidity rates and lower medical costs, but also have higher average daily gain (ADG) and lower cost of gain (COG),<sup>27</sup> ultimately leading to improved economic return.<sup>56</sup> In a study reported by Pfizer Animal Health, three separate groups of cattle were compared: those vaccinated 30 d prior to weaning and revaccinated upon arrival at the feedlot (1201 head); calves purchased directly from the ranch without prior vaccination and vaccinated upon arrival at the feedlot (1122 head); and calves purchased through an auction market with no verifiable history (392 head). Morbidity rates for calves were 2.2, 12.4 and 41.6%, respectively.<sup>2</sup>

A cattle buyer with no knowledge or history of cattle will assume them to be “average”. In the case of vaccination, approximately 25% of all operations vaccinate against viruses related to BRD at some point prior to weaning.<sup>39</sup> Of that 25%, roughly half utilize killed vaccines, but less than one-third of those using killed vaccines are boosted properly.<sup>39</sup> Therefore, less than 20% of all operations adequately vaccinate against BRD prior to weaning. As such, an order buyer with no information will assume that a calf has a less than one-in-five chance of being properly immunized.

#### *Preconditioning*

Preconditioning is a comprehensive tool to manage these physiological responses and to improve morbidity upon arrival. Preconditioning programs address both sides of the morbidity equation: they are designed to reduce the incidence of BRD by increasing resistance while simultaneously reducing stress prior to and after shipment. Calves in preconditioning programs are usually weaned at least 3 weeks before sale and trained to eat from a feed bunk. Additionally, prior to or at weaning, calves should be castrated and dehorned, treated for parasites, and properly vaccinated against clostridial and BRD pathogens.<sup>1</sup> Many preconditioning programs require calves to be weaned a minimum of 30 to 45 days.

Despite the benefits of improved management, the cattle industry has been slow to adopt preconditioning programs. As recently as 1998, survey results indicated

that only 37% of feedyards prioritize the purchase of pre-conditioned calves.<sup>10</sup> It has been estimated that less than 2% of feeder calves in the United States are pre-conditioned annually.<sup>8</sup> The reluctance to adopt preconditioning is a result of several factors. However, the most likely reason is the requirement for additional management inputs. NAHMS survey results reveal that producers are reluctant to provide additional inputs while feeder prices are depressed, and cow/calf producers usually respond to low calf prices by reducing usage of vaccine and other veterinary services.<sup>39</sup> Preconditioning programs were relatively successful in the early 1980's. Due to decreasing margins for most cow/calf operators however, ranchers' efforts to reduce input costs have generally resulted in failure to generate a consistent supply of preconditioned calves and, therefore, support of preconditioning programs within the industry has waned.<sup>59</sup>

In addition, calf health and performance benefits of preconditioning have not been consistent.<sup>52</sup> As a result, cattle feeders have been reluctant to pay large premiums for preconditioned calves, as many of the claims of preconditioning programs have failed to be substantiated.<sup>37</sup> This has important economic implications. Nearly 58% of all feeder cattle are purchased either through auctions or some type of direct sale (cash, video, private treaty).<sup>40</sup> Changes in the structure of the feedlot industry have also resulted in less enthusiasm for preconditioned calves. Increased consolidation within the industry spreads individual morbidity risk over a relatively larger number of cattle.<sup>38</sup> Lastly, most large feedyards (capacity 8,000 head or greater) custom feed cattle.<sup>40</sup> Their priority is to insure optimal performance for their customers and they are reluctant to change their standard processing procedures for various classes of calves, regardless of documentation and/or certification. In fact, only 39.9% of feedyards process preconditioned calves differently than non-preconditioned calves.<sup>40</sup> Arrival weight is the single most important factor influencing initial processing programs.<sup>40</sup>

However, the perception of preconditioned calves has improved during the past five years.<sup>41</sup> This has resulted for several reasons. First, there is increased understanding of the secondary benefits for feedyards that feed preconditioned cattle. Operating costs when feeding preconditioned calves are reduced by 12% (above purchase price) compared to feeding calves of unknown origin.<sup>46</sup> Cost savings result from a reduction in the number of rations required, decreased mill time, fewer feed trucks, less feeding time and reduced labor.<sup>46</sup> Secondly, there are economic advantages to reduced treatment rates for BRD when marketing cattle in value-based systems. Early research indicated that the reduction in morbidity among preconditioned calves was often not sufficient to offset the cost of the program,<sup>7,51</sup> but failed to address the relationship of sickness to car-

cass merit. Recent research has demonstrated the negative effect of sickness and treatment on carcass quality and economic returns when marketing cattle on a grid system,<sup>14,29-36,54,58</sup> thereby making preconditioning programs more attractive to cattle buyers.

#### *Prophylactic programs and feeder cattle market principles*

Cow/calf producers have increasingly been encouraged to add "value" to their cattle through health programs in order to improve the net worth of the calf crop. Adding "value" is equivalent to adding "relative worth", however, it is not always equivalent to adding profit. There are instances where the costs associated with additional management inputs may not be fully rewarded by premiums through the market. Table 2 outlines results from video cattle sales conducted by Superior Livestock and reflects a total of 9043 lots over the span of five years. "Value-Added Calf" (VAC, Pfizer Animal Health) programs, VAC34 and VAC45, resulted in premiums of \$1.27 and \$3.35/cwt, respectively.<sup>19-23</sup> Cattle that had been vaccinated, but not enrolled in a program, received a premium of \$.73/cwt compared to cattle not enrolled in any type of health program.<sup>19-23</sup> Therefore, certification of calf history results in relatively important premiums.

Furthermore, feeder cattle discounts due to other factors (feeder grades, genetics, lot size etc.) may offset any premiums that may have been realized from participating in a health program. Sensitivity analyses reveal that when sale prices and/or morbidity rates are high an increasing amount of money is available for treatment,<sup>24</sup> thereby reducing the importance of preventing sickness. Therefore, the cost of disease prevention programs and their effect on morbidity must be appropriately evaluated within the given economic environment. The total cost of BRD (and ultimately the value of participation in a preventive program) includes the cost of prevention, cost of treatment, morbidity rate, mortality rate, realizer rate, feed costs, loss of performance (due to both clinical and subclinical BRD), calf purchase price, calf sale price and various carcass grid premiums/discounts.<sup>16</sup>

Cattle are priced relative to a variety of important factors and interactions. The complexities of net return, and therefore the determination of true feeder calf value, will likely increase in the future as the industry increasingly turns to vertical cooperation and value-based marketing.<sup>4</sup> Currently, approximately 45% of cattle are marketed in either a fully coordinated system (~3.5%), partially coordinated system (~3.5%) or some type of captive supply agreement (~38%), including packer-owned cattle. Within the next five years that number is expected to double (10%, 20% and 60%, respectively).<sup>6</sup> Within that framework, carcass merit, cattle health and genetic uniformity will become higher priorities,<sup>44</sup> and directly re-

**Table 2.** Feeder Cattle Pricing Characteristics: Value Differences<sup>a</sup>

Year	Health Program							
	Vaccinated / No Program		VAC 34 <sup>c</sup>		VAC45 <sup>d,e</sup>		None	
	No. Lots	(\$/cwt)	No. Lots	(\$/cwt)	No. Lots	(\$/cwt)	No. Lots	(\$/cwt)
1995	608	0.70	195	1.35	50	2.47	688	Base
1996	607	0.43	497	0.99	80	3.35	609	Base
1997	631	0.72	440	1.61	85	3.89	567	Base
1998	639	0.74	514	1.38	120	3.35	433	Base
1999	854	0.96	787	1.17	179	3.33	460	Base
Total	3339		2433		514		2757	
Mean <sup>b</sup>		0.73		1.27		3.35		Base

<sup>a</sup> Adapted from King *et al* (1996, 1997),<sup>19,20</sup> King and Odde (1998)<sup>21</sup> and King (1999,2000)<sup>22,23</sup>.

<sup>b</sup> Figures reported are weighted means.

<sup>c</sup> VAC34

Vaccinated with (at 2 to 4 months of age):

7-way clostridial bacterin-toxoid

Vaccinated against: (at least 3 to 4 weeks prior to weaning):

IBR (chemically altered modified live)

PI3 (chemically altered modified live)

BVD (killed)

BRSV (modified live or killed)

Pasteurella haemolytica (with leukotoxoid component)

<sup>d</sup> VAC45 Preweaning Option

Vaccinated against (at 2 to 4 months of age or at least 3 to 4 weeks prior to weaning):

IBR (chemically altered modified live)

PI3 (chemically altered modified live)

BVD (killed)

BRSV (modified live or killed)

Pasteurella haemolytica (with leukotoxoid component)

Revaccinated against (at weaning):

IBR (modified live or chemically altered modified live)

PI3 (modified live or chemically altered modified live)

BVD (modified live or killed)

BRSV (modified live or killed)

Pasteurella haemolytica (with leukotoxoid component)

Weaned at least 45 days before shipping or sale

<sup>e</sup> VAC45 Weaning Option

Vaccinated with (at 2 to 4 months of age):

7-way clostridial bacterin-toxoid

Vaccinated against (at weaning and revaccinated 14 to 21 days later):

IBR (modified live or chemically altered modified live)

PI3 (modified live or chemically altered modified live)

BVD (modified live or killed)

BRSV (modified live or killed)

Pasteurella haemolytica (with leukotoxoid component)

Weaned at least 45 days before shipping or sale

flect the beef industry's need to lower costs while increasingly satisfying consumer demands for lean, palatable and more convenient beef products. Cow/calf producers need to prepare themselves by understanding, creating and documenting value as inter-segment communication and discovery of true value increases.

## Conclusions

Calf producers and practitioners are encouraged to understand the various factors that cause variability in feeder cattle prices in order to reduce exposure to excessive market risk, and maximize net return of the

cattle that they produce. Ever-increasing marketing of fed cattle through value-based marketing systems will also increase the importance of management inputs that improve the health status of calves. Programs providing source-verified feeder cattle that are effective in reducing health problems during the marketing process and upon arrival to their final destination will become increasingly important, and will likely receive additional economic benefits in the years to come.

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## Abstract

### Rabies Surveillance in the USA in 1999

J. W. Krebs, C. E. Rupprecht, J. E. Childs  
*Veterinary Record* (2001):148, 575

During 1999, 7067 cases of rabies were reported in animals in the USA, 6466 in wild animals and 601 in domestic species, an overall reduction of 11.2 percent compared with 1998. There were no human cases. The percentage distribution in the major groups was: raccoons 41, skunks 29.4, bats 14, foxes 5.4, cats 3.9, cattle

1.9 and dogs 1.6. Cases of rabies in horses and mules declined from 82 cases in 1998 to 65 in 1999. There were decreases of nearly 2 percent in the numbers of cases in cats and dogs, but there was an increase of 16.4 percent (from 116 to 135) in the number of cases in cattle.



## American Association of Bovine Practitioners

### Prudent Drug Usage Guidelines

The production of safe and wholesome animal products for human consumption is a primary goal of members of the AABP. In reaching that goal, the AABP is committed to the practice of preventive immune system management through the use of vaccines, parasiticides, stress reduction and proper nutritional management. The AABP recognizes that proper and timely management practices can reduce the incidence of disease and therefore reduce the need for antimicrobials; however, antimicrobials remain a necessary tool to manage infectious disease in beef and dairy herds. In order to reduce animal pain and suffering, to protect the economic livelihood of beef and dairy producers, to ensure the continued production of foods of animal origin, and to minimize the shedding of zoonotic bacteria into the environment and potentially the food chain, prudent use of antimicrobials is encouraged. Following are general guidelines for the prudent therapeutic use of antimicrobials in beef and dairy cattle.

1. The veterinarian's primary responsibility to the client is to help design management, immunization, housing and nutritional programs that will reduce the incidence of disease and the need for antimicrobials.
2. Antimicrobials should be used only within the confines of a valid veterinarian-client-patient relationship; this includes both dispensing and issuance of prescriptions.
3. Veterinarians should properly select and use antimicrobial drugs.
  - a. Veterinarians should participate in continuing education programs that include therapeutics and emerging and/or development of antimicrobial resistance.
  - b. The veterinarian should have strong clinical evidence of the identity of the pathogen causing the disease, based upon clinical signs, history, necropsy examination, laboratory data and past experience.
  - c. The antimicrobial selected should be appropriate for the target organism and should be administered at a dosage and route that are likely to achieve effective levels in the target organ.
  - d. Product choices and regimens should be based on available laboratory and package insert information, additional data in the literature, and consideration of the pharmacokinetics and pharmacodynamics of the drug.
  - e. Antimicrobials should be used with specific clinical outcome(s) in mind, such as fever reduction, return of mastitic milk to normal, or to reduce shedding, contagion and recurrence of disease.
  - f. Periodically monitor herd pathogen susceptibility and therapeutic response, especially for routine therapy such as dry cow intramammary antibiotics, to detect changes in microbial susceptibility and to evaluate antimicrobial selections.
  - g. Use products that have the narrowest spectrum of activity and known efficacy *in vivo* against the pathogen causing the disease problem.**
  - h. Antimicrobials should be used at a dosage appropriate for the condition treated for as short a period of time as reasonable, i.e., therapy should be discontinued when it is apparent that the immune system can manage the disease, reduce pathogen shedding and minimize recurrence of clinical disease or development of the carrier state.
  - i. Antimicrobials of lesser importance in human medicine should be used in preference to newer generation drugs that may be in the same class as drugs currently used in humans if this can be achieved while protecting the health and safety of the animals.
  - j. Antimicrobials labeled for use for treating the condition diagnosed should be used whenever possible. The label, dose, route, frequency and duration should be followed whenever possible.
  - k. Antimicrobials should be used extra-label only within the provisions contained within AMDUCA regulations.
  - l. Compounding of antimicrobial formulations should be avoided.
  - m. When appropriate, local therapy is preferred over systemic therapy.
  - n. Treatment of chronic cases or those with a poor chance of recovery should be avoided. Chronic cases should be removed or isolated from the remainder of the herd.
  - o. Combination antimicrobial therapy should be discouraged unless there is information to show an increase in efficacy or suppression of resistance development for the target organism.
  - p. Prophylactic or metaphylactic use of antimicrobials should be based on a group, source or production unit evaluation rather than being utilized as standard practice.
  - q. Drug integrity should be protected through proper handling, storage and observation of the expiration date.
4. Veterinarians should endeavor to ensure proper on-farm drug use.
  - a. Prescription or dispensed drug quantities should be appropriate to the production-unit size and expected need so that stockpiling of antimicrobials on the farm is avoided.
  - b. The veterinarian should train farm personnel who use antimicrobials on indications, dosages, withdrawal times, route of administration, injection site precautions, storage, handling, record keeping and accurate diagnosis of common diseases. The veterinarian should ensure that labels are accurate to instruct farm personnel on the correct use of antimicrobials.
  - c. Veterinarians are encouraged to provide written guidelines to clients whenever possible to describe conditions and instructions for antimicrobial use on the farm or unit.

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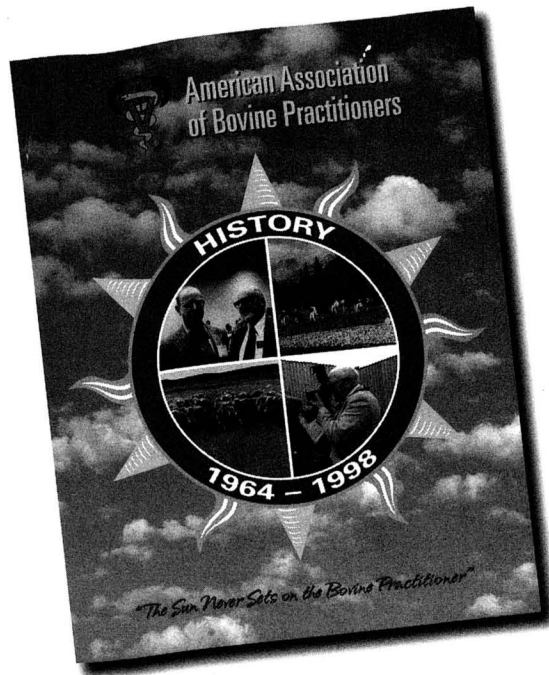
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Appreciation is extended to each of the above mentioned individuals for volunteering their time and expertise to peer review articles for *The Bovine Practitioner*.

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- Grab the bottle from the fridge.
- Guess the dosage.
- Give a shot.
- Segregate treated cows.
- Dump the milk.
- Dump the milk.
- Dump the milk.
- Dump the milk.
- Dump the milk.
- Dump the milk.
- Worry about contamination.

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